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Research article

The Relationship of Physical Activity and Central Obesity With Type 2 Diabetes Mellitus

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Abstract.

Type 2 diabetes mellitus (T2DM) is a public health problem in developing countries and has become the six highest cause of death in Indonesia. This study aimed to determine the relationship of physical activity and central obesity with T2DM. This was a case-control study, with a sample of 25 patients with T2DM in the Internist Polyclinic Dustira Hospital in Cimahi. The independent variables examined were gender, physical activity and central obesity, while the dependent variable was T2DM. Data were analyzed using the Chi-square test and odds ratios of the magnitude of the risk factor were calculated. Gender did not have a significant influence on the occurrence of T2DM (p-value = 0.40; OR = 0.5; 95% CI = 0.15-1.71). Physical activity did have a statistically significant relationship with the occurrence of T2DM (p-value = 0.0001; OR = 16.6; 95% CI = 4.04–68.04). Central obesity was also a risk factor for the occurrence of T2DM (p-value = 0.001; OR = 10.3; 95% CI = 2.77–38.21). We can conclude that the occurrence of T2DM is influenced by lifestyle factors such as low physical activity and central obesity.

Keywords: T2DM, physical activity, central obesity

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1. Introduction

Non communicable disease, such as Type 2 Diabetes Mellitus as a public health problem in developing country. The international Diabetes Federation estimated that the prevalence of type 2 Diabetes mellitus (T2DM) in the worldwide from 382 million in the year 2013 to 592 million people in 2035 [1]. The prevalence of T2DM in Indonesia (2018) showed approximately 2% [2]. Type 2 Diabetes Mellitus become the sixth causing of death in Indonesia [3]. The occurrence of type 2 Diabetes mellitus is caused by lifestyle dan eating or diet pattern, such as unhealthy diet, lack of physical activity, and obesity that should be modified factor, and risk factors cannot change such as gender, age, dan genetic factor [3].

Physical activity is a one of the pillars in the management of Type 2 Diabetes Mellitus. Daily physical activity regularly can effectively improve blood glucose control dan reduce

progression and complication of T2DM [4]. Insufficient physical activity is a risk factor for T2DM by increasing insulin resistance [4]. Regularly physical activity can improves glycemic control in patient with Type 2 Diabetes Mellitus and reduces progression dan complication for Diabetes [5]. Several studies showed that an important role of physical activity in lowering glycemic and reducing lipid profile at patients with Type 2 Diabetes Mellitus. There is a relationship between physical activity with occurrence of Type 2 Diabetes Mellitus [4]. It has become very urgent examine the variable of physical activity as a risk factor for T2DM.

Over half of all type 2 DM suffer from obesity, based on literature review by Colosia (2013), several study showed that the prevalence rate obesity in patient with type 2 DM in Qatar as many as 53.8%, Saudi Arabia 83,4% and 38%-52,7% in Taiwan [6]. Central obesity is a risk factor occurrence of Type 2 Diabetes Mellitus, central obesity plays a role with insulin resistance in patient with T2DM [7]. Measurement of central obesity such as waist-to-hip, waist-to-height ratio or waist circumference only can be provided an additional information about risk factor on morbidity and mortality among middle-aged adults and elderly. Variable central obesity in this research used waist circumference only. Several studies shown that central obesity with waist circumference only are more associated with cardiovascular disease and syndrome metabolic such as Type 2 Diabetes Mellitus than uses with Body Mass Index (BMI) and [8]–[10]. This study aims to understand the relationship between physical activity and central obesity with Type 2 Diabetes mellitus.

2. Methods

2.1. Study design

This study was an observational study with design research used case-control study. This study held in Internist Policlinic Dustira Hospital Cimahi on June until August 2021.

2.2. Sample

Population of cases in this research are patient was diagnosed with Type 2 Diabetes Mellitus (T2DM) who were registered in Internist Policlinic Dustira Hospital Cimahi. Inclusion criteria for sample cases: patients with diagnosed as having Diabetes Mellitus within the last 12 months, women and men with ages 25 to 75 years old, ability participated in this research without help. Inclusion criteria for sample controls: patient

did not diagnose with Type 2 Diabetes Mellitus within the last 12 months, man and women with ages 25 to 75 years old. We excluded participants with chronic medical conditions that restricted their activity.

Sample size calculated requires for a case control study as many as 25 people, with ratio case-control used 1:1, so that total sample in this research as many as 50 people. Sample study was taken by purposive sampling on patients with Type 2 Diabetes Mellitus in Internist Policlinic Dustira Hospital Cimahi.

2.3. Instruments

Data demographic consisted age and gender used open-ended questioner. Measurement of variable physical activity used Global Physical Activity Questionnaire (GPAQ). It assesses in which physical activity is performed (physical activity related occupational, transport and physical activity during leisure time), as well as sedentary behavior comprising 16 questions [11]. Central obesity assessed used waist circumference with tape measure, it was measured in the horizontal circumference at the midpoint between the lower border of the rib and the iliac crest or measured at the level of belly button (umbilicus) [12].

2.4. Data collection procedure

This research was approved by Ethic Committee in Stikes Jenderal Achmad Yani Cimahi with number registration: 29/KEPK/VII/2021. Variable independent consisted data demographic (age and gender), physical activity and central obesity.

Data demographic (age and gender) are taken by conducting interview with participants. Age divided into five categories, namely 25 – 35 years, 36 – 45 years, 46 – 55 years, 56 – 65 years and 66-75 years. The gender variable was divided into female and male. Physical activity was categorized as low and moderate and measured using GPAQ through face-to-face interviews with all off participants. Waist circumference used assessment for central obesity (International Diabetes Federation Criteria for South Asia), a waist measurement of ≥90 cm for male dan ≥80 for female is an indicator of central obesity [12]. Variable dependent in this research is Type 2 Diabetes Mellitus. All participants provided written informed consent before decided to participate in this study.

2.5. Data analysis

Univariate analysis was performed to explained frequency distribution each variable. Bivariate analysis was conducted to identify and analysis the relationship between independent and dependent variables using the chi-square test. The significant test used p-value with a significance level (alpha=0.05). The magnitude of risk factor T2DM was measured with Odds Ratio (OR), with 95% Confidence Interval (CI). Analysis data can be conducted in the statistic software SPSS.

3. Results

The research showed that majority participants aged between 56 – 65 years old as many as 16 people (32%), most of participant among male (70%) as shown in table 1.

TABLE 1: Characteristic participants.

Variabel	**Frequency**	**Persentase (%)**
Age		
25 – 35	6	12
36 – 45	8	16
46 – 55	10	20
56 – 65	16	32
66 – 75	10	20
Gender		
Female	15	30
Male	35	70
Total	50	100

The research showed that patients with Type 2 Diabetes Mellitus among female as many as 15 people (62.5%), with low physical activity are as many as 19 people (76%) and T2DM Patients with category of being central obesity are 20 people (80%), as shown in table 2.

In this research, showed that variable of gender was not significantly statistic with occurrence T2DM with p-value= 0.4 and OR= 0.5 (95% CI= 0.15 – 1.71). The study showed that, physical activity was statistically significant with the occurrence of Type 2 Diabetes Mellitus, with p-value= 0,0001. The magnitude of risk factor for occurrence of Type 2 Diabetes Mellitus was measured with Odds Ratio (OR) amounting to 16.6, 95% Confidence Interval (95%CI= 4,04 – 68.04), it means that people with low physical activity have a risk for occurrence of T2DM 16.6 times compared to people with moderate physical activity.

Table 2: The relationship between gender, physical activity and central obesity with T2DM.

Variable	T2DM		OR (95% CI)	p-value
	Cases	Control		
Gender				
Female	15 (62.5%)	20 (76.9%)	0.5 (0.15 – 1.71)	0.4
Male	9 (37.5%)	6 (23.1%)		
Physical activity				
Low	19 (76%)	4 (16%)	16.6 (4.06 – 68.04)	0.0001
Moderate	6 (24%)	21 (84%)		
Central obesity				
Yes	20 (80%)	7 (28%)	D10.3 (2.77-38.21)	0.001
No	5 (20%)	18 (72%)		
Total	25 (50%)	25 (50%)		

Central obesity is a risk factor for occurrence of Type 2 Diabetes Mellitus, with p-value= 0.001 and OR=10.3 (95% CI= 2.77 – 38.21), it means that people how have central obesity having a risk for occurrence of T2DM 10.3 times compares to people don't have central obesity.

4. Discussion

In this research showed that patient with T2DM with low physical activity as many as 76%, compared with research by Trisnadewi (2019), showed that people with T2DM having low activity as many as 52. 9%, and Wang (2018), the percentage population had a low physical activity level as many as 28.6% [4]. Physical activity associated with low physical activity)p-value= 0.0001), according to the research from Simbolon (2020), the study showed that people with less activity has twice a risk factor of having Diabetes Mellitus compared with people with very physically active [3]. Based on research by Wedati (2014), showed significant difference in the average fasting blood sugar level among respondent (p-value= 0.011). The average blood sugar level in the group with less physical activity was 98.95 mg/dl, while in the group has sufficient physical activity is 92.7 mg/dl [13]. Lack of physical activity causes the total energy consumed to exceed compared with total of energy released, it can be energy stored in the adipose tissue[13]. The lack of physical activity with the high consumption of carbohydrates, and fat can caused increase free fatty acid in cell, it will reduce the translocation of glucose transporters to the plasma membrane and caused insulin resistance in people with Type 2 Diabetes Mellitus [3]. World Health Organization recommended about physical

activity at least 150 minutes a week for moderate activity or at least 75 minute of vigorous-intensity aerobic [4]. Moderate to vigorous physical activity is recommended to manage T2DM [5].

In this research founded that 80% patient T2DM had central obesity, to comparison, in a research conducted by Munir (2015), the percentage of central obesity in patient with T2DM as much as 79% [7], and Trisnadewi (2019), founded that respondent with T2DM and how have central obesity amounted that 56,9%. Central obesity was significantly with occurrence of T2DM (p-value= 0.0001), this research is in according with research conducted by Trisnadewi with p-value= 0.031 [14] and meta-analysis conducted by Fremantle (2008), there was strong association between abdominal obesity with the occurrence of Type2 Diabetes Mellitus with p-value < 0.0001 and OR 2.14 (95% CI= 1,7 – 2,71) [15] Risk factor the occurrence of Type 2 Diabetes Mellitus such as obesity, which is caused by poor dietary habit and lifestyle [16] based research by Fajarini (2013), nutritional knowledge was significant (p-value= 0.047; OR= 2,3) with obesity in patients with T2DM.

In people with central obesity, there is a release of free fatty acids into the blood circulation. Mobilization of fat will be faster from the visceral area compared to subcutaneous fat. The increase in free fatty acids will stimulate the release of adipocytokines hormones such as leptin, tumor necrosis factor (TNF-α), interleukin-6 (IL-6) The release of adipocytokines hormones results in increased gluconeogenesis, block insulin receptors and inhibit muscle glucose transport can lead to insulin resistance as a cause of type 2 diabetes mellitus [14], [17]. Reduction central obesity or abdominal obesity may lead to risk factor the occurrence of T2DM dan progression on diabetes [15]. Based on research Kosaka et al, showed that a life style intervention with physical activity: walking 30-40 minute/day, using staircase of an elevator or an escalator, 30 minute cycling on weekend, and combined with diet therapy reduces the risk of T2DM by 67,4% [5]. The limitation of this study is that when measuring waist circumference, respondents do not reveal their clothes because they are in an open room, so the clothes affect the measurement results.

5. Conclusions

The occurrence of T2DM is due to lifestyle change such as low physical activity and people who are central obesity. Reduction of central obesity with diet and regularly physical activity can be reduction of risk factor for T2DM. Type 2 Diabetes mellitus can cause various complication, and it can be declining quality of life and physical activity.

It is recommendation for patients with Type 2 Diabetes Mellitus to routinely measured waist circumference as an indicator for weight loss intervention to prevent complication, reducing progression and mortality of T2DM.

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